

neath us? The canvas was prepared of old time, but the design first traced upon it has been modified again and again by natural agents; new pigments have been absorbed by it, while others have changed their nature, and have often become more beautiful and permanent in their decay. The describer of a rock, the petrographer, may well pause before it, and proceed to fill in the details with an almost affectionate care.

Is life, in fact, so brief that the name assigned to each object must express it completely in its habit as it lived?

We have no right to raise objections to the scheme of these four serious and conscientious workers, on the ground that it involves a considerable tax upon the memory. Yet we may question the advantage of compressing all our information into the tabloid form, and leaving the reader to dissect the compound in order to find out its contents. Abbreviation goes far when a rock, already accepted as *dosalane* in class, that is, with silica-alumina minerals predominant in its norm, is also found to be *grano-hornblende-germanare*.<sup>1</sup> In the scheme proposed, there is special virtue in the last syllables of such words. Yet what would be gained for the correct appreciation of a work of art if it were described as *samsodelic angelo-italare*, because it contained (or might in other circumstances have contained) Samson and Delilah, and belonged to the Italian school of which Michael Angelo is the representative? Or should we describe the House of Commons for 1903 as *unanim-hibern-britannare*, and also as *dochamberlane*, on account of the predominance of a particular constituent? "Is't not possible to understand in another tongue?"

Were we to comment on all the details selected as a basis for rock-classification, we should unduly extend the present notice. The historic review is of great interest and value, and the proposal (p. 180) to revert, for field-purposes, to the old loose signification of granite, diorite, &c., has some points in its favour. Similar reasoning, however, would allow us to speak of a mineral as a fossil; nor are the historic authorities always correctly invoked by the reformers of petrography. D'Aubuisson, that is to say, Haüy, from whom he had the term, does not (p. 182) use aphanite in the wide sense stated; for him, it is a compact diorite, with amphibole predominant over felspar. If we loosen the bonds of peridotite (p. 183), we must go back to Cordier, and use it for a basalt or dolerite rich in olivine. As for felsite (p. 184), the authors can hardly have realised the odd mixture of materials associated under the name by Gerhard. It may be sufficient to mention labradorite felspar and the pitchstone of Meissen as felsitic rocks in the sense of the inventor of the term.

However, we conclude as we began; there are persons who desire classification in order to promote accuracy of comparison. Such accuracy must be welcomed by every geologist, where individual specimens are concerned. Whether it is of so much service when we consider rock-masses as portions of the earth's

crust is a question for the worker in this or that particular district. At any rate, our authors have sought perfection in the domain on which they set their gaze. To all of us is the mission sent, of Sir Persalane, Sir Salfemane, Sir Dofemane, and Sir Perfemane—for we cannot but regard these names (p. 102) as those of champions seeking for a Grail. The path is lit by their high endeavour, even if we may not follow it to the end.

GRENVILLE A. J. COLE.

#### ALTERNATING CURRENT ENGINEERING.

*Die Grundgesetze der Wechselstromtechnik.* By Dr. Gustav Benischke. Pp. 141. (Brunswick: Friedrich Vieweg und Sohn, 1903.) Price 3.60 marks.

THIS volume, the third issue of "Elektrotechnik in Einzel-Darstellungen," comes as rather a surprise after the first two highly specialised parts of this series on lightning arrestors and the parallel running of alternators. In order to peruse the book with profit, the reader must be acquainted with the fundamental theory of electricity and magnetism, and also with the general laws of electrical engineering. Ability to use the differential and integral calculus is also necessary, in order to understand the mathematical reasoning given.

The book is divided into six parts—introduction, the simple alternating current circuit, mutual induction, capacity phenomena, composite wave forms, and polyphase currents. The arrangement and scope of the book will render it of most use to the practical electrical engineer, who, though using certain symbols and equations every day, yet is apt to lose sight of their fundamental origin, and, in order to comprehend new problems, needs, now and then, to refresh himself in the theoretical basis of his work. Such a simple thing as the measured value of an alternating current is an example of what we mean. Every engineer knows, of course, that what he calls the current is the root of the mean of the squares of the instantaneous values of the current. Why this should be, and to prove the reason why, would, we think, puzzle a good many men who would be very much insulted if they were told that they could not do so. The why and the wherefore of this matter is set forth in the introduction of the book. Part ii. deals chiefly with the application of Ohm's law to the alternating current circuit, the work done by an alternating current and the use of vectors. The third and largest part of the book is concerned mostly with the laws of the transformer. No attempt to treat of design is made, nor is the practical performance of any actual machines studied. The subject is treated purely from the theoretical engineering point of view.

Part iv., on capacity, is very short, and does not give much beyond the deduction of the formula for the calculation of the effective current in a circuit containing resistance, self-induction and capacity, and also showing the conditions under which electrical resonance can occur. Part v. is the most useful of the book, as it serves as a guide to the difficult task of dealing with the irregular wave-forms given by alternators and transformers. The appendix can be used in con-

<sup>1</sup> Mr. H. Stanley-Jevons (*Geological Magazine*, 1901, p. 313) has already attempted such term, as *Sodali-midalkalite* and *Ægiangi-natrijolite*. It would of course be similarly possible to express a whole chemical analysis by a skillfully constructed word some decimetres in length.

junction with this division of the book, as it contains a set of formulæ, deduced from Fourier's theorem, with the coefficients worked out, for calculating the harmonics (up to the 11th) of an alternating current waveform. The author states that in all curves actually met with in practice, the 13th and higher harmonics can be neglected, as they are so small. This is, however, not true. It has been recently shown that in the E.M.F. curve of the alternators of the Glasgow Corporation Tramways, the 13th harmonic is one of the most important, and alternators may very well exist in which the 15th and 17th harmonics are the largest.

The last division, on polyphase currents, does not do more than show the general star and delta relationships, and contains a chapter on the measurement of three-phase power.

As stated above, the book will be mainly useful to practical engineers who desire to have at hand a volume which will help them out of mental entanglements which arise from time to time in working with alternating currents. The general theory (general differential equation) of the electric circuit is not dealt with at all. This being so, we of course find no mention of the exponential terms which vanish with time, and which appear in the full solution of the general equation. These, though airily dismissed by many writers, are really of the utmost importance, as on them depends the theoretical treatment of all the important phenomena met with in electric switching, and oscillations set up by sudden changes in the current flowing. These exponential terms certainly constitute a "Grundgesetz," and as such should have been mentioned. The work is closed by a table of formulæ, but that greatest sin of omission, no index, is committed.

C. C. G.

#### THE PRINCIPLES OF DYEING.

*The Principles of Dyeing.* By G. S. Fraps, Ph.D., of North Carolina College. Pp. xii+270; with 22 illustrations in the text. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1903.) Price 7s. net.

IN the preface to this work the author states that "it attempts to apply to the teaching of dyeing the same methods of class-room work, coordinated with experiments in the laboratory, which have proved so successful in the teaching of inorganic chemistry and other branches of science," and its novel feature consists in the insertion, interspersed throughout the text, of a series of experiments, seventy-nine in number, which the student is to carry out in the laboratory.

Although no such division is made by the author, the book may conveniently be considered in two portions, chapters i. to vi. giving a general survey of the subject in 53 pages, while the remaining sixteen chapters, occupying 200 pages, are devoted to a systematic amplification.

This larger portion of the book follows the lines adopted in most modern text-books on dyeing, and little need be said in reference to it beyond the obvious remark that, even with the most careful condensation, it is not possible, without dangerous generalisations,

to compress into 200 small pages any adequate discussion of the various matters treated under the headings cotton, linen, wool, silk, bleaching, scouring, machinery, general observations, direct cotton colours, basic colours, acid colours, mordant colours, insoluble colours, mercerisation, dyeing of unions, theory of colour, spectrum analysis, dye testing and detection of dyes. The inevitable result of too general statement follows; for example, on p. 251 the following sentence is found:—"A dye on cloth has nearly the same absorption-spectrum as a solution of the dye of corresponding strength." This is by no means the case, since the hue of the dyed fabric often differs considerably from that of a simple solution of the dye. In the same section a normal spectrum is figured, while the description refers to the prismatic spectrum.

Less importance, however, should be attached to slight errors of statement than to the general scope of the work, and from this point of view the chief interest attaches to the preliminary chapters, to which the author's statement, quoted in the first paragraph, chiefly applies. After a short introductory chapter dealing with the fibres and explanatory of the scheme of the book, the following five sections are each devoted to a study of the composition and characteristics of one of the important groups of dyes, one or two members of each group being used as illustrative of the group. The scheme is well worked out, but sufficient care has not been taken to prevent, what is always a pitfall to students, over generalisation; and instead of giving the student a clear general view of dyeing phenomena, he will probably acquire, by a perfectly logical process, some very erroneous views. For example, chapter vi. is devoted to indigo, chrome yellow, theory of dyeing, and classes of fibres. Now indigo and chrome yellow have absolutely nothing in common, either chemically or in mode of application, and there is not a word of explanation as to the reason for coupling them together until chapter xix. is reached, when it is seen that it is based on the fact that they both form insoluble pigments on the fibre—a purely artificial and altogether insufficient connection.

One would expect, in a book of this type, that the various theories which have been put forward to account for dyeing phenomena would receive considerable attention, but they are not only dismissed in a page and a half, but are quite incorrectly stated.

The experiments detailed in the text are in most cases well chosen, and add greatly to the value of the book, but a student of inquiring mind may well ask why cotton should be dyed with Congo-red in an *alkaline* bath and wool in a *neutral* bath, and the results considered as comparative (Exp. 4). Exp. 12 should certainly be modified. It is highly dangerous to tell a student to pour boiling concentrated sulphuric acid into water, even if the word "caution" is interpolated.

This book is very welcome as an obviously original attempt to teach the general principles of dyeing on novel lines, and most of its shortcomings are explainable by the opening sentence in the preface:—"This book is the result of two years' instruction in dyeing."

W. M. G.